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PAPER-TESTING STANDARDS

At the annual meeting of the Technical Association of the Pulp and Paper Industry held in February, B. W. Scribner, of the Bureau of Standards, chairman of the paper-testing committee, presented a report of the activities of the committee for the past year. The following is a summary of the report:

The committee is still concentrating on the development of official association testing methods. During the past year three new methods were completed—gloss, opacity, and bulk—and the first two have been adopted by the association as standards. The adoption of these two optical methods gave considerable impetus to their use as a part of the testing routine for control of paper-making processes.

Considerable development work was done on specific projects allotted to four different subcommittees. Under the leadership of E. O. Reed much progress was made in further standardizing a method for measuring the resistance of papers to printing inks, and a satisfactory method for this important determination will no doubt

be available in the near future. The subcommittee on microscopical methods, headed by Prof. C. E. Libby, made an intensive study of the "dot" method for determination of fiber composition. They proved that this modification gives increased accuracy, particularly in the case of the more inexperienced analyst. Miss H. U. Kiely's subcommittee on chemical methods obtained test data which will lead to considerable improvement of the present official methods for quantitative determination of starch and paraffin. Progress was made in developing a method for quantitative determination of acidity and an improved method for detection of formaldehyde. For acidity, it is believed that a modified Kohler-Hall method, whereby a water extract of the paper is tested in the presence of the fibers in an atmosphere freed of carbon dioxide, will permit much greater accuracy. The subcommittee on permeability to liquids, Allen Abrams, chairman, obtained considerable valuable data through cooperative tests by various laboratories, of the degree of concordance to be expected in determination of degree of sizing and

grease resistance. For the former, the methods proposed by the Bureau of Standards gave very promising results. Various modifications of H. A. Smith's method for grease resistance gave rather conflicting results and considerable further development of it is necessary.

During the current year, in addition to the continuing work indicated, development work will probably be initiated on determination related to permanence, such as alpha cellulose, copper number, effect of light, and effect of heat.

COOPERATIVE DEVELOPMENT OF PERMANENT LEDGER PAPER

A striking example of the value of correlating laboratory tests and mill practice was recently experienced. At the request of a paper-manufacturing concern, the bureau is cooperating with them in improving the quality of a rag fiber permanent ledger paper found to be deficient in some respects. Exhaustive permanence tests showed that the paper was exceedingly strong, having a folding endurance of around 25,000 folds. When subjected to the heat treatment, however, the paper darkened, increased excessively in copper number, and decreased excessively in alpha cellulose, all of which indicated that the paper contained degraded celluloses and, therefore, that it would be of doubtful permanence. As the highest grade of raw materials was used in its manufacture, it was surmised that some detail of the manufacturing processes was faulty. The original copper number was low, therefore, the cellulose degradation was attributed to either excessive hydration in beating or to the high rosin content. The manufacturer made a subsequent paper with exactly the same raw materials but with much milder beating, as is indicated by the lower folding endurance of 6,000 folds. This paper in all respects appeared to have the maximum quality for permanence as it was practically unaffected upon heating for 72 hours at 100° C. Apparently excessive hydration was the prime cause of the previous poor quality.

TRANSPARENCY OF TRACING CLOTH TO ULTRA-VIOLET LIGHT

In view of the inquiries received regarding the transparency of tracing cloth, about which there has been considerable publicity in the press, transmission tests have been made on this material.

Tracing cloth consists of thin, loosely woven fabric of linen or cotton, impregnated with a highly soluble, transparent starch. The drawback in the use of such a material for a window is the high solubility of the sizing which dissolves when touched with water, leaving the cloth in a rough condition which is then no better than other thin, bleached, loosely woven material, such as, for example, nainsook or balloon cloth.

The bureau has determined the transmission of tracing cloth and finds that the total ultra-violet of wave lengths 250 to 310 $m\mu$ diffusely transmitted through a new sample of tracing cloth amounted to about 26 per cent before wetting, and 14 per cent after removing the sizing and drying the cloth.

In Table 1 of Bureau of Standards Research Paper No. 6, which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents per copy, are recorded the ultra-violet transmissions of a sample of balloon fabric (transmission, 21 per cent), of batiste (transmission, 16 per cent), and of nainsook (transmission, 31 per cent), showing that tracing cloth is not superior to other fabrics for use as a window for transmitting ultra-violet radiation.

WINTER DAMAGE IN LAUNDRIES

In a talk before the Massachusetts Laundryowners' Association at Boston, Mass., on April 6, J. J. Wilkie, of the Bureau of Standards, outlined the progress of the work at the bureau on "winter damage." A report on this work will be published later in the year when the experimental studies now under way have been completed.

The "winter-damage" problem has attracted considerable attention for six or eight years and four theories of the cause of the damage have been advanced. They are: (1) Sulphur dioxide theory (fume smoke), (2) chemical theory (catalysis in bleach bath), (3) bacteria theory, and (4) combination of above given theories. The evidence in support of no theory has been conclusive and the laundrymen have not known how to prevent the damage. At the request of the Laundryowners' National Association in 1927, the bureau undertook to determine facts which might lead to a solution of the "winter-damage" problem.

Since the damage occurs chiefly in the New England district, field work has been carried out in several laundries near Boston. The fact that the damage is found only in wet wash, which is returned to the customer to be dried and ironed, led to a comparison of the effect of home finishing with laundry finishing. It was found that the breaking strength of towels which were repeatedly washed, dried outdoors, and ironed by hand decreased faster than the breaking strength of similar towels washed at the same time and finished in the laundry. That this deterioration may be attributable in part, at least, to atmospheric sulphur dioxide was shown by exposing damp towels to air containing 1 part per 1,000,000 of sulphur dioxide, ironing, moistening the towels, and repeating the treatment. Towels processed in this way decreased in strength at about the same rate as towels which were washed in the laundry, hung outdoors, and dried. Towels containing small amounts of iron deteriorated much faster than towels containing no iron. Very small amounts of chlorates, or of soap mixed with sodium hypochlorite, such as might remain in the goods from the laundry, also promoted deterioration of towels when exposed to air containing sulphur dioxide.

It was observed that "winter damage" was prevalent in laundries using satisfactory washing procedures. However, traces of active chlorine were sometimes found in the final rinse in these laundries. The rinse water sometimes contained iron (red water) during the day as well as in the morning, and chlorine gas was sometimes evident in the atmosphere of wash rooms which were improperly ventilated during cold weather. The experiments referred to above indicate that iron and chlorine may play a part in "winter damage" and should be avoided as far as possible.

Chemical analyses of many damaged articles have been made. They show that sulphuric acid is practically always present in cases of typical "winter damage." Iron or other oxidizing agents usually are present. It was found that during typical "winter-damage" weather, overcast days in the winter time, wet towels took up sulphur dioxide when exposed in ordinary city air in Washington, D. C., and became acid in reaction. This did not occur on clear, dry days, but often did occur when the towels were hung out overnight. Similar results were obtained in New England. This may be more likely to occur in New England because New England water is deficient in the buffer salts present in water in other parts of the country. Sulphur dioxide in cloth is readily oxidized to sulphuric acid, which is injurious, especially when heated, as when the wash is ironed.

In order to prevent goods from becoming harmfully acid when hung outdoors during winter, a special alkaline treatment was devised. Calcium bicarbonate is formed in the final rinse by the action of sodium bicarbonate and calcium chloride. A small amount of calcium bicarbonate remains in the cloth when it is dried. This process has been used during the past winter in two New England laundries. A material decrease in

the amount of "winter damage" has resulted.

EFFECT OF SERVICE ON THE ENDURANCE PROPERTIES OF RAIL STEELS

A series of tests has been carried out to determine the effect of service on the endurance properties of rail steels, and the complete report will appear in a forthcoming number of the Bureau of Standards Journal of Research.

In a previous report (Technologic Paper No. 363, obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 35 cents per copy) data were given on the endurance properties of steels from new rails from 11 distinct heats. A hypothesis based on the phenomena of "overstressing" and "understressing" was presented whereby it was considered possible to determine whether the steel of the rails in service was subjected to stresses greater or less than its endurance limit by a comparison of the endurance limits before and after service.

Through the cooperation of the Baltimore & Ohio Railroad and the Canadian Pacific Railway, a total of 18 rails were removed from track after being subjected to over 20,000,000 and 12,000,000 tons of traffic, respectively. These were principally A and B rails from six heats tested before service, and one heat not previously tested.

The endurance properties were determined in the same manner as for the rail steels before service.

In the rails returned from service on the Baltimore & Ohio Railroad the endurance properties of the steel were found to be the same as before service.

Tests were made to determine the effect of appreciable surface flow and consequent hardening of the top of the head of the rail in service on the endurance properties of the steel in that rail. No evidence was found of any "overstressing" or "understressing" having occurred.

It was concluded that under the service conditions to which the rails were subjected on the Baltimore & Ohio Railroad

the steel in the head of the rail was not subjected to fatigue stresses greater than its endurance limit.

The results of similar tests of rails after service on the Canadian Pacific Railway were not as definite in their indications. In most cases the test specimens showed a very marked "scatter" in endurance properties, indicating appreciable inhomogeneity in the steel. This "scatter" was found to be due to the presence of groups of minute transverse cracks or so-called shattered zones in the rail as removed from service.

Microscopic examination showed the cracks to be principally transcrystalline, but in a few instances evidence of intercrystalline failure was apparent indicating failure while the metal was hot; that is, before service.

Examination of a new rail from one of the same heats showed the presence of shatter cracks; premature failure of a fatigue-test specimen from a new rail of the same heat was also found to be due to the presence of an internal crack.

It was, therefore, believed that the cracks found in the service rails, and consequent wide scatter of results obtained in the endurance tests, may have been due to cracks present in the new rail and not to conditions which originated in service.

In cases where the endurance tests were not affected by the presence of cracks, the endurance properties were found to be comparable with those given by tests before service, indicating that service had not imposed repeated stresses greater than the endurance limit of the steel. It was concluded that fatigue failure in service, transverse fissures, spread from a preexisting nucleus.

Comparative tests were also made on steel from a rail which failed in service due to a transverse fissure, and an adjacent rail in track which had been subjected to the same traffic conditions. The endurance limit of the steel from the fissured rail was found to be appreciably greater than that from the unfissured rail from which it was concluded

that failure due to transverse fissure is not due to fatigue stresses alone, but develops from a preexistent nucleus.

A MODIFIED METHOD FOR THE DECOMPOSITION OF CERAMIC SILICATES FOR CHEMICAL ANALYSIS

The method ordinarily used for decomposing silicates preparatory to their chemical analysis consists of fusing them with several grams of sodium carbonate. In connection with the routine analysis of some china clays, fire clays, and other aluminous silicates, the bureau has recently used a method for decomposing them which is not well known, but which apparently can be used quite advantageously for certain silicates.

The method consists essentially of intimately grinding together a weighed amount of the silicate with not more than an equal weight of sodium carbonate, transferring the mixture to a platinum crucible and heating it for about an hour over a Tirrill or Meker burner. Ten milliliters of water are added to the cooled crucible, which is then placed on a steam bath. After a few minutes 10 ml. of hydrochloric acid are added and the mixture is evaporated to dryness. Ten milliliters of concentrated hydrochloric acid are added, after which the crucible is filled practically full of water, digested for a few minutes and the dehydrated silica filtered and washed. The combined R_2O_3 is precipitated and reprecipitated in the usual manner and the analysis completed in the ordinary way.

The amount of sodium carbonate required and the temperature of burning depend on the nature of the silicate. The most desirable condition is obtained when neither sufficient sodium carbonate nor heat is used to yield a glassy or vitrified mass in the crucible. For different materials the amount of soda ash may range from 0.2 to 0.5 g. and the temperature from that of a dull red to the highest temperature obtainable with a Meker burner. No recommendation can be made at present as to the amount of soda ash that should be used or the temperature required, but a few trials

by chemists dealing with materials of a similar nature will indicate the most desirable combination.

The evidence on which the value of this procedure is based is that the non-volatile residue after treating the dehydrated silica with hydrofluoric and sulphuric acids generally does not exceed 1 mg. A decided advantage in this procedure is that the decomposition of the silicate and the dehydration of the silica can be carried out in the crucible in which the "sintering" was done. The greatest advantage, however, lies in the fact that the amount of sodium oxide to be washed out of the various precipitates may in some cases be reduced from 4.5 to 0.2 g.

COEFFICIENT OF EXPANSION OF ENGLISH CHINA CLAYS

Determinations of the coefficient of linear expansion of 17 English china clays which had been fired to seven different temperatures were made by the Fizeau-Pulfrich method, which has been in use at the bureau for the measurement of small dilatations for a number of years. Because of the fine-grained character of the clays and the fact that there was no admixture present, this method was considered to be the best for the purpose. The clays had been fired to cones 3, 5, 7, 11, 14, 18, and 23.

The thermal expansion curves obtained are practically linear in character over the range investigated, from room temperature to 600° C. An interesting fact brought out in the investigation is the peculiar behavior noted in the linear expansion curves for all the clays that had been fired to cones 3, 5, and 7. In each case a "kink" was shown in the curve in the approximate range of 120 to 280° C., where the slope of the curve decreased considerably. This was probably caused by the presence of some water in the sample, but in just what form it was present it is impossible to say without further investigation of the matter. In each case a second determination resulted in a linear thermal expansion curve over the range from

room temperature to 600° C., from which the mean coefficient of linear expansion was calculated. The calculated mean coefficients showed a minimum value 0.501×10^{-5} , with an average value of 0.387×10^{-5} .

From an examination of the results obtained, it would appear that the average tendency was for a gradual increase in the value of the mean coefficient of linear expansion from cone 3 to cone 11, followed by a gradual decrease in the values obtained for the clays fired at the higher temperatures.

NEW SOUNDNESS TEST FOR LIME

In the course of an investigation of factors causing unsoundness in lime plasters a new method for experimentally determining unsoundness has been developed. The lime which is to be tested, either quicklime, or hydrated lime, is made into a putty by the addition of water. One part of gaging plaster is added to two parts of the lime putty, and after thorough mixing, the paste is spread in a thin layer on an absorbent porcelain plate. The plate is then allowed to remain undisturbed for about one hour, or until the paste has set. It is then placed in autoclave and steamed for two hours at a steam pressure of from 20 to 25 lbs./in.² The plate is then removed from the autoclave and examined. Unsoundness is evidenced by popping, pitting, or cracking of the plaster.

The procedure as a whole follows the general method for the use of the lime in plaster. The mixture of lime and gaging plaster is the same as would be used in the finish coat on a wall. The porcelain plate takes the place of the base coats of plaster. The steaming under pressure apparently produces in a few hours conditions which are obtained only after months of ordinary exposure.

The results obtained by this test are being checked by preparing panels of the same materials which are allowed to age in the laboratory, and are being

examined periodically. The present standard method for determining unsoundness is that proposed by the American Society for Testing Materials (A. S. T. M. Standards, 1927, Pt. II, p. 48). Thus far five limes which appeared to be sound by the A. S. T. M. method have been found unsound by the new method. All five limes have developed unsoundness in the panels prepared from them.

The new test has an advantage over the present standard test in that it may be completed in four hours or less, whereas the standard test requires three days for completion. It also requires less expensive apparatus and apparently does not require as careful control of testing conditions as is required in the A. S. T. M. test.

XYLOSE FACTORY IN OPERATION

The xylose factory at Anniston, Ala., started operating on March 16. On that date there were produced 35 pounds of white crystalline xylose. This factory is operated on a cooperative basis by the Alabama Polytechnic Institute, the University of Alabama, the Federal Phosphorus Co., and this bureau. All of the equipment is not yet in place, so that the factory is not in full production. It is designed to produce 100 pounds of xylose per day.

STANDARD VISCOSITY SAMPLES

Supplementing the statement contained on page 27 of Technical News Bulletin No. 143 (March, 1929) on standard viscosity samples, the bureau is prepared to furnish quart samples of oil of known viscosity at 100 and 122° F. at a cost of \$5 per sample. The oils at present available have viscosities of approximately the following values:

70, 150, 300, 550 seconds, Saybolt Universal at 100° F.

225 seconds, Saybolt Furol at 122° F.
Exact values (within ± 0.5 per cent) will be furnished at time of purchase.

The above temperatures for calibration were selected in accordance with

the report of the committee on viscosity standards, American Petroleum Institute, 1922-1924. The bureau is not prepared to furnish samples for calibrating Saybolt viscometers at other temperatures.

The report above referred to may be obtained from the American Petroleum Institute, 250 Park Ave., New York, N. Y.

NEW AND REVISED PUBLICATIONS ISSUED DURING MARCH

Journal of Research ¹

Bureau of Standards Journal of Research, Vol. 2, No. 3, March, 1929, (RP Nos. 45 to 49, inclusive). Obtainable only by subscription. (See footnote.)

Research Papers ¹

RP45. Apparatus and methods for the separation, identification, and determination of the chemical constituents of petroleum; E. W. Washburn, J. H. Bruun, and M. M. Hicks. Price, 10 cents.

RP46. Recombination spectra of ions and electrons in caesium and helium; F. L. Mohler and C. Boeckner. Price, 5 cents.

RP47. The spectral absorption of certain monoazo dyes: I. The effect of position isomerism on the spectral absorption of methyl derivatives of benzeneazophenol; W. R. Brode. Price, 15 cents.

RP48. Transmission of sound through wall and floor structures; V. L. Chrisler and W. F. Snyder. Price, 10 cents.

RP49. Discharge coefficients of square-edged orifices for measuring the flow of air; H. S. Bean, E. Buckingham, and P. S. Murphy. Price, 20 cents.

¹ Send orders for publications under this heading with remittance only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 25 cents per year (United States, Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 40 cents. Subscription to Bureau of Standards Journal of Research, \$2.75; other countries, \$3.50.

Simplified Practice Recommendations ¹

RX-28. Organization of the American Marine Standards Committee and its constitution and rules as revised in 1928. Price, 10 cents.

R47-28 (2d ed.). Cut tacks and small cut nails. Price, 10 cents.

R92-28. Hard fiber twines (ply and yarn goods). Price, 5 cents.

Building and Housing ¹

BH13. Recommended minimum requirements for plumbing. Report of subcommittee on plumbing of the Building Code Committee, revised August 30, 1928. Price, 35 cents.

Technical News Bulletin ¹

TNB144. Technical News Bulletin, April, 1929. Obtainable only by subscription. (See footnote.)

OUTSIDE PUBLICATIONS ²

Measure temperature of molten cast iron. H. T. Wensel and W. F. Roeser; The Foundry (Cleveland, Ohio), Part I published in Vol. 57, No. 5, p. 184; March 1, 1929; and Part II in Vol. 57, No. 6, p. 245; March 15, 1929.

Series in the arc spectrum of bromine. T. L. de Bruin and C. C. Kiess; Science (New York, N. Y.), Vol. LXIX, No. 1787, p. 360; March 29, 1929.

An interlaboratory comparison of colored photometric filters. E. C. Crittenden and A. H. Taylor; Transactions, Illuminating Engineering Society (New York, N. Y.), Vol. XXIV, No. 2, p. 153; February, 1929.

¹ Send orders for publications under this heading with remittance only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 25 cents per year (United States, Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 40 cents. Subscription to Bureau of Standards Journal of Research, \$2.75; other countries, \$3.50.

² "Outside publications" are not for distribution or sale by the Government. Requests should be sent direct to publishers.

- The Raman spectra of scattered radiation. W. W. Coblenz; *The Philosophical Magazine* (London, England), Vol. VII, p. 204; January, 1929.
- The fungicidal action of ultra-violet radiation. H. R. Fulton and W. W. Coblenz. *Journal of Agricultural Research* (Washington, D. C.), Vol. 38, No. 3, p. 159; February 1, 1929.
- The quality average of the continuous X-ray spectrum. Discussion of papers by Dr. Burby and Dr. Barry; Dr. Mutscheller. L. S. Taylor; *Radiology* (Chicago, Ill.). Vol. XII, No. 4, p. 289.
- Color change preceding occultation of Sigma Sagittarii. Hugh G. Boutell; *Popular Astronomy* (Northfield, Minn.), Vol. XXXVII, No. 3, p. 186; March, 1929.
- Observation of Jupiter on November 8, 1928. Hugh G. Boutell; *Popular Astronomy* (Northfield, Minn), Vol. XXXVII, No. 3, p. 180; March, 1929.
- The carburizing test for quality in case-hardening steel. S. Epstein and H. S. Rawdon; *Industrial Gas* (New York, N. Y.), Vol. 7, p. 9; March, 1929.
- Reducing corrosion trouble in boilers. H. S. Rawdon and K. H. Logan; *Iron Age* (New York, N. Y.), Vol. 123, p. 666; 1929.
- Corrosion embrittlement of duralumin versus results of weather-exposure tests. H. S. Rawdon; National Advisory Committee for Aeronautics (Washington, D. C.), Technical Note No. 304; March, 1929.
- A study of refractory blocks in a small experimental glass plant. W. L. Pendergast and Herbert Insley; *Journal, American Ceramic Society* (Columbus, Ohio), Vol. 12, No. 2, p. 123; February, 1929.
- "Performance" specifications. A. S. McAllister; *Purchaser* (New York, N. Y.), Vol. VIII, No. 2, p. 3; February, 1929.
- Applying Government specifications to utility purchasing. A. S. McAllister; *Public Utility Purchasing* (New York, N. Y.), Vol. 1, No. 1, p. 17; February, 1929.
- The opus majus of Roger Bacon. Paul R. Heyl; *Science* (New York, N. Y.), Vol. LXIX, No. 1785; p. 302; March 15, 1929.
- The following articles were published in the series on Physical Science in the *United States Daily* (Washington, D. C.):
- L. V. Judson: Geodetic tape standardization; March 13, 1929.
- Henry D. Hubbard: Measurement in Government service; April 2, 1929.

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